

## Environmental Protection Agency

## § 86.334-79

(d)-(e) [Reserved]

[42 FR 45154, Sept. 8, 1977, as amended at 46 FR 50495, Oct. 13, 1981; 47 FR 49807, Nov. 2, 1982; 52 FR 47869, Dec. 16, 1987; 58 FR 58423, Nov. 1, 1993]

### § 86.333-79 Dynamometer calibration.

(a) If necessary, follow the manufacturer's instructions for initial start-up and basic operating adjustments.

(b) Check the dynamometer torque measurement for each range used by the following:

(1) Warm up the dynamometer following the equipment manufacturer's specifications.

(2) Determine the dynamometer calibration moment arm. Equipment manufacturer's data, actual measurement, or the value recorded from the previous calibration used for this subpart may be used.

(3) Calculate the indicated torque (*IT*) for each calibration weight to be used by:

$IT = \text{calibration weight (lb)} \times \text{calibration moment arm (ft)}$

(4) Attach each calibration weight specified in § 86.312 to the moment arm at the calibration distance determined in step (2). Record the power measurement equipment response (ft-lb) to each weight.

(5) For each calibration weight, compare the torque value measured in step (4) to the calculated torque determined in step (3).

(6) The measured torque must be within 2 percent of the calculated torque.

(7) If the measured torque is not within 2 percent of the calculated torque, adjust or repair the system. Repeat steps (1) through (6) with the adjusted or repaired system.

(c) *Option.* A master load-cell or transfer standard may be used to verify the in-use torque measurement system.

(1) The master load-cell and read out system must be calibrated with weights at each test weight specified in § 86.312-79. The calibration weights must be traceable to within 0.1 percent of NBS weights.

(2) Warm up the dynamometer following the equipment manufacturer's specifications.

(3) Attach the master load-cell and loading system.

(4) Load the dynamometer to a minimum of 6 equally spaced torque values as indicated by the master load-cell for each in-use range used.

(5) The in-use torque measurement must be within 2 percent of the torque measured by the master system for each load used.

(6) If the in-use torque is not within 2 percent of the master torque, adjust or repair the system. Repeat step (2) through step (5) with the adjusted or repaired system.

(d) The dynamometer calibration must be completed within 2 hours from the completion of the dynamometer warm-up.

### § 86.334-79 Test procedure overview.

(a) The test consists of prescribed sequences of engine operating conditions to be conducted on an engine dynamometer. The exhaust gases generated during engine operation are sampled for specific component analysis through the analytical train. The test is applicable to engines equipped with catalytic or direct-flame afterburners, induction system modifications, or other systems, or to uncontrolled engines.

(b) The tests are designed to determine the brake-specific emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen. The gasoline-fueled engine test consists of 1 warm-up cycle and 1 hot cycle. The Diesel engine test consists of 3 idle modes and 5 power modes at each of 2 speeds which span the typical operating range of Diesel engines. These procedures require the determination of the concentration of each pollutant, the fuel flow and the power output during each mode. The measured values are weighted and used to calculate the grams of each pollutant emitted per brake-horsepower hour.

(c)(1) When an engine is tested for exhaust emissions or is operated for service accumulation on an engine dynamometer, the complete engine shall be tested, with all emission control devices installed and functioning.

(2) Evaporative emission controls need not be connected if data are provided to show that normal operating

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conditions are maintained in the engine induction system.

(3) On air cooled engines, the fan shall be installed.

(4) Additional accessories (e.g., oil cooler, alternators, air compressors, etc.) may be installed with advance approval by the Administrator.

(d) All emission control systems installed on or incorporated in a new motor vehicle engine shall be functioning during all procedures in this subpart. In cases of component mal-

function or failure, maintenance to correct component failure or malfunction shall be authorized in accordance with § 86.079-25.

**§ 86.335-79 Gasoline-fueled engine test cycle.**

(a) The following test sequence shall be followed in dynamometer operation tests of gasoline-fueled heavy-duty engines. Diesel engines are covered in § 86.336.

| Cycle No. | Mode No. | Mode         | Observed torque (percent of maximum observed) | Time in mode-seconds | Cumulative time-seconds | Weighting factors |
|-----------|----------|--------------|---|----------------------|-------------------------|-------------------|
| 1 .....   | 1 .....  | Idle .....   | .....   | 60                   | 60                      | 0.232             |
| 1 .....   | 2 .....  | Cruise ..... | 25  | 60                   | 120                     | .077              |
| 1 .....   | 3 .....  | PTA .....    | 55  | 60                   | 180                     | .147              |
| 1 .....   | 4 .....  | Cruise ..... | 25  | 60                   | 240                     | .077              |
| 1 .....   | 5 .....  | PTD .....    | 10  | 60                   | 300                     | .057              |
| 1 .....   | 6 .....  | Cruise ..... | 25  | 60                   | 360                     | .077              |
| 1 .....   | 7 .....  | FL .....     | 90  | 60                   | 420                     | .113              |
| 1 .....   | 8 .....  | Cruise ..... | 25  | 60                   | 480                     | .077              |
| 1 .....   | 9 .....  | CT .....     | .....   | 60                   | 540                     | .143              |
| 2 .....   | 10 ..... | Cruise ..... | 25  | 60                   | 600                     | .077              |
| 2 .....   | 11 ..... | PTA .....    | 55  | 60                   | 660                     | .147              |
| 2 .....   | 12 ..... | Cruise ..... | 25  | 60                   | 720                     | .077              |
| 2 .....   | 13 ..... | PTD .....    | 10  | 60                   | 780                     | .057              |
| 2 .....   | 14 ..... | Cruise ..... | 25  | 60                   | 840                     | .077              |
| 2 .....   | 15 ..... | FL .....     | 90  | 60                   | 900                     | .113              |
| 2 .....   | 16 ..... | Cruise ..... | 25  | 60                   | 960                     | .077              |
| 2 .....   | 17 ..... | CT .....     | .....   | 60                   | 1,020                   | .143              |
| 2 .....   | 18 ..... | Idle .....   | .....   | 60                   | 1,080                   | .232              |

(b) Except for idles, the engine dynamometer shall be operated at a constant speed of 2000 rpm±100 rpm. Speed deviations, not to exceed 200 rpm, will be allowed during the first 10 seconds of each mode.

(c) The times in-mode specified in paragraph (a) for the CT modes are ±2 seconds. All other times in-mode are ±4 seconds.

(d) The first 35 seconds of each 60 second engine power mode is allowed for engine-dynamometer stabilization. After this stabilization period the torque must be held at the specified value ±5 percent until the exhaust gas analysis period. During the exhaust gas analysis period, the last 10 seconds of each nonclosed throttle mode the engine torque must be at the specified value ±2 percent of the maximum torque observed. For example, mode 3 torque shall be held between 53 and 57 percent of maximum torque (55±2 percent) during the exhaust analysis pe-

riod. Prior to the analysis period but excluding the first 35 seconds of the mode, the torque shall be held between 50 and 60 percent of maximum torque (55%±5%).

(e) The idle operating mode shall be carried out at the manufacturer's recommended curb-idle engine speed. Arrive at the last idle mode by closing the throttle, braking the dynamometer to the engine idle speed, and unloading the dynamometer.

(f) The CT operating mode shall be carried out at the same engine speed as specified in paragraph (b) of this section.

(g) If the Administrator determines that an engine shall be tested as an automatic transmission code engine, then a load shall be applied by the dynamometer during the idle modes (1 and 18) such that the engine speed is decreased from the recommended dynamometer-idle speed to the recommended curb-idle speed. The engine